

THE COUNCIL FOR TOBACCO RESEARCH - U.S.A., INC.

110 EAST 59TH STREET  
NEW YORK, N. Y. 10022

Application For Research Grant

JUL 27 1972

Date: July 7th 1972

1. Name of Investigator(s): (include Title and Degrees)

Professor H.J. Eysenck, Ph.D., D.Sc.

2. Institution &

Address:

/Department of Psychology  
/Institute of Psychiatry  
DeCrespigny Park, London, SE5 8AF  
/England

3. Short Title of Project:

The Inheritance of the Smoking Habit

4. Proposed Starting Date: January 1st 1973

5. Anticipated Duration of this Specific Study: 3 years

6. Brief Description of Objectives or Specific Aims:

The objective of the proposed study is to investigate the heritability of the tobacco smoking habit. There have been several attempts in the past to do this, briefly reviewed in Section 8; these fail to come up to modern methodological requirements and cannot be interpreted in terms of an acceptable genetic model. The proposed study seeks not only to partition the variation in the population into environmental and genetic causes, but also to provide information on the type of gene action involved, and to permit a statistical test of the adequacy of the assumptions underlying the genetical model to be used. An additional objective of the study is to discover the degree to which the genetic and the environmental parts of the individual's smoking behaviour are determined by personality factors, and to investigate in turn the extent to which these are inherited.

7. Give a Brief Statement of your Working Hypothesis:

The hypothesis to be investigated states that a significant proportion of the total variants of smoking behaviour is determined by hereditary causes.

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**8. Details of Experimental Design and Procedures: (Attach Separate Pages)**

See Attached Paper

**9. Physical Facilities Available (Where Other than Administering Organization Indicate Geographical Location)**

Departmental facilities include a twin register which will be used extensively for this study, and card punching and computer facilities, including direct access to University Computer facilities.

**10. Additional Requirements:****11. Biographical sketches of all principal and professional personnel (append)**

No final decision has yet been made about the professional assistants to be appointed, and consequently the only biographical sketch included is that of the principal investigator.

**12. List of publications: (Five most recent as pertinent) (append)**

Five relevant papers are quoted in the

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## 13. Budget: (1st year)

3.

## A. Salaries (Personnel by names)

## Professional

Psychologist

Social Worker

Consultant (Dr. L. Eaves)

% time

Amount

£

100%

2,500

100%

2,200

10%

500

## Technical

Secretary

100%

1,500

Sub-Total

## B. Consumable Supplies (list by categories)

Tests

300

Sub-Total

7,000

## C. Other Expenses (itemize)

Postage

Travel

300

200

Sub-Total

7,500

## D. Permanent Equipment (itemize)

## E. Overhead (15% of A+B+C)

Total

1,125

8,625

## Estimated Future Requirements:

	Salaries	Consumable Suppl.	Other Expenses	Permanent Equip.	Overhead	Total
Year 2	£ 7,000		200		1,080	8,280
Year 3	£ 7,300		200		1,125	8,625

It is understood that the applicant and institutional officers in applying for a grant have read and found acceptable the Council's "Statement of Policy Containing Conditions and Terms Under Which Project Grants Are Made."

Signature

Director of Project H. J. Eysenck

Signature

Business Officer of the Institution

Telephone

Telephone

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O.K.  
R.E.H.

## Other Sources of Financial Support

List financial support for research from all sources, including own institution, for this and/or related research projects.

Current

Title of Project

Source

Amount

Duration

Pending

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# THE INHERITANCE OF THE SMOKING HABIT

## A. The Problem

The investigation here described was planned in order to investigate the heritability of the tobacco smoking habit; the aim is not only to enable the variation in the population to be partitioned into environmental and genetic causes but also to provide information on the type of gene action involved, and to permit a statistical test of the adequacy of the assumptions underlying the genetical model to be used. The general problem of the genetic determination of smoking is clearly central to such theories as Fisher's, which attempt to relate the statistical correlation between smoking and disease (e.g. lung cancer) to a genetic cause responsible for both smoking and disease. A theory of this type has been elaborated by the writer (Eysenck, 1965), by relating smoking to personality type, and by showing that personality type was also related to the development of cancer (Kissen and Eysenck, 1962); it will consequently also be part of the present study to investigate simultaneously with the genetic determination of smoking the genetic determination of personality type.

## B. Previous Work

Several studies have been done in this field since Fisher's (1958) early work; we may mention the work of Friberg et al. (1959), Todd and Mason (1959), Raaschou-Nielsen (1960), and Conterio and Chiarelli (1962). These studies have employed the classical method of using monozygotic twins reared together and dizygotic twins reared together; either intraclass correlations are calculated for both groups of twins, and an index of heritability obtained, or the ratio

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of the within-pair variance of the DZ twins to that for MZ twins is used as an F-test of the importance of genetic factors in determining variation. There are two primary deficiencies in these classical studies; they fail to take account of variation due to genetic and environmental influences acting between families, and they can provide no conclusive information about the type of gene action involved. More informative is a study done here at the Institute by Shields (1962), in which an additional sample of MZ twins reared apart was used, but the statistical treatment fell short of modern methods, and cigarette and pipe smoking were confused by adding these two different methods of consumption into one single index. It may be concluded that the evidence is suggestive but not conclusive, and that it leaves many questions unanswered, particularly those relating to gene action. Even with respect to the purely genetic question of the degree to which smoking is determined by hereditary factors no clear answer can be given in view of the neglect of the between-family variance.

#### C. Methodology: Statistical

The approach of biometrical genetics developed by Fisher and, following him, by Mather (1949) provides the basis for a genetically meaningful evaluation of the principal components of variation which is readily extended to the analysis of continuous variation in the human population. The application of biometrical genetics to human psychogenetics has been the subject of a study by Jinks and Fulker (1969), and it is proposed to use their model and statistical treatment for the purposes of analysing the data to be obtained in this study. The general principles underlying this approach will be found in Mather and Jinks (1971), and it would be out of place to go into them

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in detail here. The writer has worked with Professor Jinks in the past, and Dr. L. Eaves, a member of his team, has agreed to act as Consultant to this project and has been helpful in making suggestions relating to the choice of a suitable sample (cf. Section E, *infra*). Here, it may be useful merely to note the main advantages of this new approach.

1. The new approach begins by postulating a proper genetic model and incorporates tests for genotype-environment interaction and genotype-environment correlation. The randomness of mating and the equality of environmental components for twins, sibling and half-siblings are assessed after the analysis by the test of goodness of fit of the model.
2. The model provides an assessment of the relative importance of dominance.
3. The model provides a meaningful assessment of between-family variation and of interaction. These are important advantages, compared with the paucity of information that could be obtained by means of the classical method of twin comparison.

#### D. Methodology: Experimental

It is intended to obtain information by questionnaire on each person's smoking habits both present and past, including questions on inhaling, cigarette, cigar and pipe smoking, and in particular of course the amount of tobacco consumed. The questionnaire to be used would be modelled on that used in our past enquiries (Eysenck et al., 1960; Eysenck, 1963). A second questionnaire would deal with the occasions on which a person was most likely to smoke; the

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questionnaire to be used is the one prepared and used in our laboratory by Frith (1971), which has been shown by factor analysis to measure two main tendencies, i.e. to smoke under conditions of boredom and fatigue, or to smoke under conditions of stress and anxiety. A third questionnaire would deal with personality variables, particularly extraversion-introversion, which has in the past been shown many times to be related to smoking, and neuroticism-stability which has been shown to correlate with smoking only in women (Eysenck, 1973). In addition, the questionnaire would contain a Lie Scale, to test for test-taking attitude and dissimulation (Michaelis and Eysenck, 1971), and another mental health scale which in preliminary work we have found to correlate with smoking (unpublished). The total questionnaire would be printed, with instructions, and laid out to make transfer of results to computer cards easy; all analyses would be carried out on the computer, using specially written programmes.

#### E. Methodology: Sampling

The choice of the sample to be tested is of course crucial to the whole investigation as the parameters of the model require to be measured and tested for fit by reference to particular types of family relations. It is possible to deduce from the model quantitative rules which maximise the information obtained for each test carried out (Eaves, 1969), and Dr. Eaves has kindly worked out an optimum set of pairs, with optimum numbers for each set of pairs, to use in the proposed investigation. The list is as follows:

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<u>PAIRS</u>	<u>NUMBER OF PAIRS</u>
Father-son together	200
Mother-daughter together	150
Father-daughter together	100
Mother-son together	100
Male sibs together	150
Male sibs apart	100
Female sibs together	150
Female sibs apart	100
Unlike sex sibs together	150
Unlike sex sibs apart	100
Male MZ together	100
Female MZ together	100
Unrelated males together	150
Unrelated females together	150
Foster-father - Foster-son	150
Foster-father - Foster-daughter	150
Foster-mother - Foster-son	150
Foster-mother - Foster-daughter	150

Professor Jinks has suggested that, in addition, data be obtained from the parents of sib pairs, and from the relatives of parent-child pairs. This would provide a "second sample" from which data could be selected if necessary to augment particular statistics for further analysis. Something like 1,000 families should provide enough independent pairs to satisfy the requirements of the design and provide supplementary data. It will be clear that these are "ideal"

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requirements; it is unlikely that we will be able to obtain all the needed data, or that we will be able to obtain them in the precise proportions laid down. Fortunately the design is not rigid, in that some of the information is redundant; the skill in the analysis lies of course in making optimum use of what information is in fact available. It is for this reason that Dr. Eaves would be retained as Consultant.

Partly in preparation for this study, we have inaugurated a twin register which, at the moment, contains approximately 1,000 pairs of twins; these will provide us with the beginning of our sample, together with their sibs, parents, grandparents and other relatives. Foster children will of course have to be traced separately, through adoption agencies.

#### F. Budget

The work requires two Psychologists, or one Psychologist and one Social Worker, to trace and contact the subjects for the investigation; it is too early to be able to name the people involved. In addition, one Secretary would be required. Dr. L. Eaves would act as Consultant. In addition, there is provision for postage and printing, and for travel as not all the subjects live within the Greater London area. \* Details are given on the official form. It is proposed that the study should continue for three years in all. I would personally direct the project and be responsible for the analysis and the writing up of the results, but my services do not form part of the budget.

\* Not all the subjects will be contacted by letter, and quite a number (e.g. foster-children and parents) will require personal contact.

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